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## Training switching focus with a mobile-application by a patient suffering from AVH, a case report

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Auditory verbal hallucinations complicate many psychiatric disorders. Antipsychotic medication is effective in the majority, but a significant minority experiences high burden from resistant hallucinations. Here, we aim to improve executive control, in an attempt to decrease burden from hallucinations. We describe the use of a cognitive trainings app by a young woman with highly resistant hallucinations. With modest training, a significant decrease in the duration of hallucinations was reached. Possibilities of this training technique are discussed.

**Key words:** Hallucinations, cognition, executive control, mobile application, dichotic listening.

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### INTRODUCTION

Auditory verbal hallucinations (AVHs) complicate many psychiatric disorders, such as schizophrenia, affective disorders, autism and personality disorder. While antipsychotic medication is effective in the majority of patients with this complaint, a significant minority experiences high burden from resistant AVH. Prof. Hugdahl (2015) suggested that AVHs arise from abnormal spontaneous activity in the auditory cortex as well as a failure of executive control (Hugdahl, 2015). The extinction of hallucinatory experiences is concomitant to a functional takeover of the central executive network (Lefebvre, Demeulemeester, Leroy *et al.*, 2016). In this report, we target the second component, namely executive control, which has been shown to be modifiable by various cognitive training methods (Melby-Lervåg & Hulme, 2013). It is hypothesized that through improvement of this cognitive domain, the severity of AVHs can also be reduced, as suggested by Hugdahl, Nygård, Falkenberg *et al.* (2013). One way to train executive functions is through the dichotic listening forced attention conditions (Bless, Westerhausen, Kompus, Gudmundsen & Hugdahl, 2014).

### THE PARTICIPANT

In this case report we describe the use and effect of a cognitive training app on a 35 year old female patient, diagnosed with a psychotic disorder with predominantly AVH (auditory verbal hallucinations) and depression. She is in a stable relationship with a supportive partner. As a child the patient experienced sexual abuse. At this time, she obeys the voices, who are constantly present and order her to 'destroy or harm' herself. She suffers from anxiety and has concentration problems.

She asked for a second opinion in the University Medical Centre of Utrecht as she still was severely troubled by the AVH despite former treatment (medication and psychotherapy).

She started treatment at the Voices Clinic of UMC Utrecht. At the Voices Clinic, patients suffering from AVHs are treated in a group program combined with individual coaching and medication (Sommer, 2011). The informed consent was obtained before the patient started to train with the app.

For patients who are severely disturbed by their voices, it is important to have possibilities to shift their focus of attention. This simple strategy can make a difference in their mood and render them less vulnerable to their voices (Løberg, Jørgensen, Kroken & Johnsen, 2015; Van Gastel & Daalman, 2012). However, patients report finding it difficult to distract themselves at all times and finding effective methods for distraction and being able to stay focused on them. The use of the cognitive training app might help patients to actively train themselves in switching their focus of attention.

### THE APP – MOBILE AUDITORY ATTENTION TRAINING APPLICATION

The app is based on the focus-attention conditions of the standard consonant – vowel dichotic listening (CV – DL) paradigm (Hugdahl, 2004) and runs on an iPod touch (Apple Inc., Cupertino, CA). The app was developed by a team at the University of Bergen, Norway under the supervision of prof. Hugdahl. Previously, the app was used to train healthy individuals to improve their auditory attention abilities (Bless *et al.*, 2013). Upon opening the app, the patient is instructed to concentrate on basic language sounds (CV syllables: ba/da/ga/ka/ta/pa) that are presented simultaneously in pairs of all

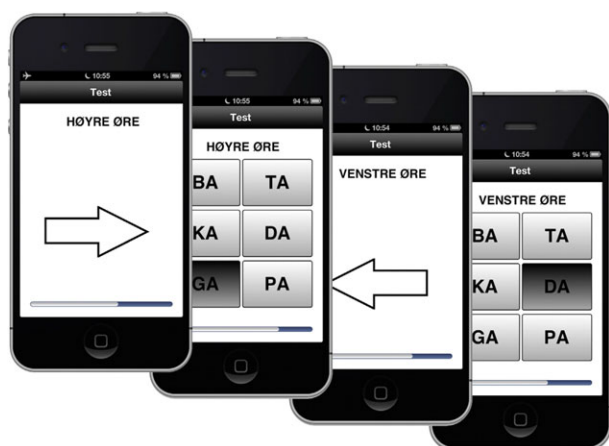


Fig. 1. Training application illustration (taken from Bless *et al.*, 2014). iPhone screenshots of the instruction-screens (focus on right ear, focus on left ear) and response-screens with answer buttons. The bar on the bottom of the screens depicts the remaining time for the current answer and until the next stimulus is presented. [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

possible combinations via earphones (standard Apple), one syllable to the right ear and another one to the left ear. The concentration focus is either on the syllable presented to the right ear, or to the one presented to the left ear and changes after every fifth CV-pair. An arrow on the screen shows which ear to listen to. Altogether, there are 30 pairs, with 15 pairs in one direction and 15 pairs in the other. The answer is given by touching the screen on the heard syllable (Fig. 1). The patient has four seconds for each answer before a new sound pair is presented. The whole training session takes about three minutes. After each session, feedback is given in terms of percentage correct response, also visible for left and right ear specifically. Each new exercise is adjusted to a chart, so the patient is able to see improvement or differences in each exercise.

## PROTOCOL

The Questionnaire for Psychotic Experiences (QPE) was assessed before and after training, in order to compare pre and post scores on hallucinations. For the training, the patient received an iPod touch, where the app was installed on. No restrictions on time of day and how often the patient should use the app were given; however, we did advise the patient to use the app on a regular basis and for 14 days. Instructions on how to use the app were given and the patient was explicitly asked to stop using the app if she had the idea that her complaint got worse.

During the testing period, the patient kept using her medication (no changes were made) and she kept participating in the group program of the Voices Clinic (once a week on Wednesdays). The app training was conducted at the patient's home.

## OUTCOME MEASURES

Psychotic phenomena were explored using the QPE. The QPE is a 50-item observer-rated Questionnaire for Psychotic Experiences (QPE) developed by our group (QPE, Questionnaire for Psychotic

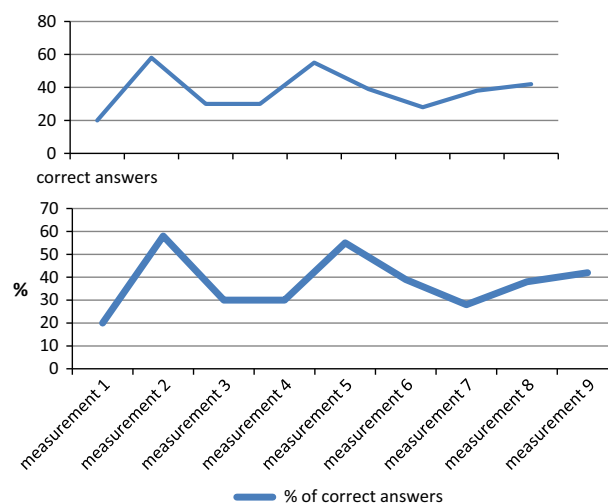


Fig. 2. Training results during testing period. [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

Experiences, n.d.). The QPE consists of 50 items categorized into four subscales; Auditory Hallucinations (A); Visual Hallucinations (V); Hallucinations in Other modalities (O); and Delusions (D). The QPE was developed to include the most important psychotic experiences covering all disorders, including auditory, visual, olfactory and tactile hallucinations, sensed presence, illusions, delusional ideation, and delusions. The development and validation of the QPE is further described in Schutte *et al.*

## RESULTS

The data on the app device show that patient exercised once a day during the time of the test. She started with 20% correct answers and had a score of 40% correct answers in the last exercise (Fig. 2). Her highest score was 58% of correct answers.

On the QPE, the severity experienced by the auditory hallucination decreased from 15 to 13, in which the patient reported that the voices were at the start present at least once an hour, and at the end of the testing period at least once a day.

At the end of the testing period, we asked the patient for feedback on the use of the app. She reported that the app somewhat helpful, easy to use and it changed her perception of the voices somewhat.

## DISCUSSION

This case report demonstrates the potential influence of supplementary interventions when medication and psychotherapy do not give the desired effect for patient with resistant AVHs. As the app training targets focused attention, that is proposed to underlie AVHs, one might expect positive results also in patients across diagnosis, suffering from prominent AVHs. It might also be expected that longer duration of training or more frequent training sessions would yield better results on the symptom level. Since this was a case study, conclusions that can be drawn from its results are limited and warrant further investigation a larger sample. If validated in a clinical population, this app could be used as relatively cheap, easy and

not stigmatizing way of getting better control of hallucinations for affected patients.

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